Managing Risk in the Shipping Industry: Methodological, Theoretical and Applied Implications for Safety Climate Research

Berit Bergslid Salvesen

Master's degree in psychology

Department of Psychology, University of Oslo

May 2008

Acknowledgements

Several people figured in this project and I want to acknowledge with appreciation their help and support. My supervisor, Thomas Hoff, showed me great trust by engaging me in this project. He gave me valuable advice and guidance throughout the writing process. My co-supervisor, Roald Bjørklund, has supported this project through his methodological guidance. I am truly grateful to both of them.

Kjell Ivar Øvergård and Pål Ulleberg have generously granted their time to assist in the statistical data analysis. Per Straumsheim has provided practical advice and arrangements regarding the process of collecting and analyzing data. I appreciate their help and assistance. Thanks also to Kate Lopez for proofreading my thesis.

Jens Christen Rolfsen from Det Norske Veritas has helped me acquiring an overview over the theoretical foundations for safety in the practical community of safety-critical industries. He has also given me advice and ideas on designing the project and supported me throughout the writing process. For this help he has earned warm thanks.

The anonymized shipping company, Fortuna, shall have the honor for making this project possible and for professional, practical and financial support. Without this support it would have been impossible to carry out the project. The management in Fortuna has generously given me insight into their worldwide organizational network without restrictions. This project has given me a professional and personal growth that I consider priceless. A special appreciation goes to my mentors in the company, Gro Myrhaug Sletnes and Svein Ommundsen, for giving me a persistent and patient introduction to the world of shipping.

Last, but not least, a warm thought to my fellow student in this project, Johannes Imset. Thank you for your patience and considerate nature in the process of collecting and analyzing data, a process that was demanding for both of us.

Table of contents

Abstract

The present study addresses methodological, theoretical, and applied issues in safety climate research. Thirty SWOT-based semi-structured interviews were carried out in a large shipping company and its organizational network. This measurement approach was evaluated on its ability to produce data important for safety climate. The results show that this approach gives accurate indications of the construct: 77.3 % of safety-related statements in the interviews reflected the Safety Climate Model (Flin, Mearns, O'Connor, & Bryden, 2000). A qualitative evaluation of this model was also carried out to give a theoretical contribution to the model's construct validity. The model was compared with an applied model for human factors – the Campaign Model – constructed from a safety campaign developed in the community of high-risk industries. Results indicate that *communication* – as defined in the Campaign Model – should be included in the Safety Climate Model: 47.6 % of the statements not reflected in the Safety Climate Model, were accounted for by the communication dimension in the Campaign Model. The statements reflected in the Campaign Model were further applied as an indication of the campaign's effectiveness in raising awareness on human factors: 71.5 % of all the statements were reflected in the Campaign Model, hence also in the safety campaign, indicating a high level of awareness on human factors probably due to the campaign.

On March 24, 1989, the tanker Exxon Valdez, on route from Valdez, Alaska to Los Angeles, California, ran aground on Bligh Reef in Prince William Sound, Alaska. The vessel was traveling outside normal shipping lanes in an attempt to avoid ice. William Murphy, a ships pilot, was hired to assist in maneuvering the 300 meters long vessel through the Valdez Narrows. At his side was the Captain of the vessel, Joe Hazelwood. Helmsman Harry Claar was steering. After passing through Valdez Narrows, Pilot Murphy disembarked. The Exxon Valdez encountered icebergs in the shipping lanes and Captain Hazelwood ordered Claar to take the Exxon Valdez out of the shipping lanes to go around the ice. He then handed over control of the wheelhouse to Third Officer Gregory Cousins with instructions to turn back into the shipping lanes when the vessel reached a certain point. At that time, Claar was relieved by Helmsman Robert Kagan. For reasons that remain unclear, Cousins and Kagan failed to make the turn back into the shipping lanes and the ship ran aground on Bligh Reef at 12:04 a.m. The Exxon Valdez spilled approximately 41 million of its 200 million liters cargo of crude oil. The oil spill would eventually impact over 1770 kilometers of coastline in Alaska, making the Exxon Valdez the largest and best known oil spill to date in U.S. waters.

The National Transportation Safety Board investigated the accident and determined five probable causes of the grounding: (a) The third officer failed to properly maneuver the vessel, possibly due to fatigue and excessive workload; (b) the Master failed to provide a proper navigation watch, possibly due to impairment from alcohol; (c) Exxon Shipping Company failed to supervise the Master and provide a rested and sufficient crew for the Exxon Valdez; (d) the U.S. Coast Guard failed to provide an effective vessel traffic system; and (e) effective pilot and escort services were lacking (Encyclopedia of Earth: http://www.eoearth.org/article/Exxon_Valdez_oil_spill).

Human factors were, without a doubt, contributing factors, if not the only factors involved in all the identified probable causes of this disaster. The accident shocked the whole shipping industry and since then, preventive attempts to improve safety in the shipping industry have been particularly focused around one finding that seems to be consistent in the majority of accident investigations: 60-80 % of all accidents in the shipping industry can be traced back to human factors (Perrow, 1999).

Identifying and understanding potentially risky situations is the key contribution of human factors in systems design. Optimizing the human interaction with systems involves identifying human factors that enhance performance and reduce errors, increase safety and increase user satisfaction (Weich & Sutcliffe, 2001).

Human factors can be identified on several levels within an organization. The immediate level of which to study human factors is the personnel level (Hetherington, Flin, & Mearns, 2006). This level deals with human performance factors or behaviors that may directly contribute to or prevent incidents or accidents. Hetherington et al. (2006) have identified the following human factors on the personnel level commonly involved in maritime incidents: fatigue, stress, health, situation awareness, decision making and cognitive demands, communication, language and cultural diversity, and teamwork.

An underlying level of which human factors can be studied is the organizational level. Human factors on this level are identified in the decisions, policies, or procedures made at the organizational level (management values and practices) - in the field of psychology commonly referred to as safety climate (Hetherington et al., 2006). Organizational safety climate is often described as a snapshot of selected aspects of the organizational culture at a particular time (Mearns, Whittaker, & Flin, 2003). One commonly used definition of safety climate was proposed by Zohar (2000), where climate perceptions relate to "procedures as patterns", whereby consistent procedures represent patterns that reflect the importance and prioritization of safety over competing goals.

An increased emphasis on non-technical skills among seafarers has resulted in innumerable training and simulation programs. The strategies implemented to decrease the number of accidents related to human factors have, however, largely been unsuccessful because they have failed to acknowledge that accidents cannot be prevented solely by introducing countermeasures on the personnel level. Research in recent years has therefore focused more on human factors on the organizational level and on developing strategies designed to change the safety climate within the whole organization (Perrow, 1999).

The present study

The present study has been carried out in a large Bermuda-based shipping company (operating in Norway), anonymized as Fortuna, and its organizational network. Every year since 2002, the company has invested between four and six million Norwegian kroner in a safety campaign targeted at human factors. The purpose has been to raise awareness and promote changes in attitudes and behaviors among all personnel connected to the organizational network.

The study has three main objectives. First, it will aim to give a contribution to the methodological discussion concerning measurement approaches to safety climate (e.g. Schein, 2004; Schneider, 2000) by answering the question: Can a precise, valid, and reliable

indication of safety climate be obtained by using semi-structured interviews as a measurement approach? To provide input on this question, the study will apply a method for performing interviews never previously used as a measurement approach to safety climate. Second, the study will give a contribution to a theoretical discussion. A state-of-the-art model for safety climate (Flin, Mearns, O'Connor, & Bryden, 2000), referred to in this study as the Safety Climate Model, will be compared to a model for human factors derived from Fortuna's safety campaign (from here on termed the Campaign Model): Are there any factors involved in determining safety climate that are not included in the Safety Climate Model proposed by Flin et al. (2000)? The purpose is to investigate whether an applied model for human factors - the Campaign Model - developed in the practical community of safety-critical industries, can give a theoretical contribution to the further developments of the Safety Climate Model (Flin et al., 2000). Third, an indication of the effectiveness of Fortuna's safety campaign will be deduced through the comparison of the Safety Climate Model and the Campaign Model. These practical implications are not worthless to the study's theoretical contribution, however, as they will stipulate the premises for the findings.

A theoretical framework for studying organizational safety climate as well as an account for the theoretical foundations of the Campaign Model will be given through the following.

Theoretical framework

Organizational culture and climate

Organizational culture and climate both describe employees' experiences of their organization. The two concepts are interconnected in many ways. Organizational culture can be seen as a "state" of the existing system, even as one knows that the system is dynamic and perpetually evolving. Shared values, common assumptions, or patterns of beliefs held by organizational members will then create the foundation for culture (Hale, 2000; Schneider, 2000). Climate, on the other hand, must in this respect be understood as a cultural artifact resulting from espoused values and shared assumptions, manifested in behavior (Schneider, 2000).

Many have argued (e.g. Schneider, 2000; Patterson, West, Shackleton, Dawson, Lawthom, Maitlis, Robinson, &Wallace, 2005) that in order for a climate construct to be useful, it should be strategically focused - climates for creativity, innovation, safety, or

service, for example. The climate may then be found in the procedures and patterns of interactions, and behaviors that support these qualities in the organization.

The many attempts to differentiate between the two concepts have also influenced the approaches of how to measure them. Most climate research has been focused on quantitatively based questionnaire measures applied comparatively across several organizations, while most culture researchers have advocated the use of qualitative measures with a focus on single organizations (Ashkanasy, Wilderom, & Peterson, 2000). The rationale behind these two different measurement approaches has been that behavior, as an indication of climate, is easier to measure through quantitatively based questionnaires than the more underlying, hidden and indirect values and norms thought to represent culture (Svyantek & Bott, 2004).

The concept of organizational safety climate

The concept of safety climate is a strategically focused approach for studying the broader and super ordinate concept of organizational climate. The earliest located paper on safety climate is from 1951 (Keenan, Kerr, & Sherman, in Guldenmund, 2000). Since then, theory and research paradigms have improved, but not to the extent that a comprehensive theory on safety climate exists, nor has a measurement approach been developed that is widely acknowledged.

Factors in safety climate – the Safety Climate Model. Many climate researchers have postulated that safety climate perceptions refer to those attributes of policies, procedures and practices that indicate the true priority of safety (e.g. Zohar, 2000; Zohar, 2002). These may vary from the formal declarations, strategy, or profile. The actual climate thus reflects a silent agreement regarding how to prioritize safety, not an objective measure of formal policies, procedures and practices that can be linked to safety. For example, if safety issues time after time are being ignored or prioritized over production pressure, the workers will relate this to low safety priority, which again will lead them to draw the conclusion that speed is more likely to be rewarded before safety (Zohar & Luria, 2005).

In a review of the research that has attempted to measure safety climate, Flin et al. (2000) sought to identify a common set of factors that are being regularly included in measures of safety climate. 18 published reports on safety climate surveys were reviewed after a literature search, eliminating surveys that did not live up to predefined criteria. In the final sample, 50 % of the studies were from the energy/petrochemical sector.

Flin et al. (2000) identified six features in the reviewed surveys, and proposed an additional two: The prime theme identified as worthy of measurement in relation to organizational safety climate involves perceptions of *management attitudes and behavior* in relation to safety as well as to production, or other issues (selection, discipline, planning, etc.). The theme was included in all the reviewed surveys. It is generally measured by respondents' satisfaction with supervision or their perceptions of the supervisors' attitudes and behaviors with respect to safety. The second theme identified in almost every survey was labeled *safety systems* and involves many different aspects of the organization's safety management system, including safety officials, safety committees, permit to work systems, safety policies and safety equipment. Generally, respondents were asked to indicate their satisfaction with such aspects of the safety system or to indicate agreement/disagreement with statements relating to system performance. The third theme, *risk* was frequently included but appeared under many labels, for example; self-reported risk taking, perceptions of risk/hazards on the worksite and attitudes towards risk and safety. Work pace and workload was the fourth theme and appeared in a number of surveys. It was labeled *work pressure.* A related theme, which overlaps this variable (and the management attitudes and behaviors variable), is the balance maintained between pressure for production on the one hand and safety on the other. The fifth theme was related to *competence*, and covers the employees' perception of the general level of workers' qualifications, skills and knowledge, with associated aspects relating to selection, training, competence standards and their assessment. This factor is also likely to be influenced by broader economic conditions such as the labor market for a particular industrial sector, and available training budgets. In the shipping industry, together with other industries, there is an increasing emphasis on competence in non-technical skills (e.g. leadership, decision making) which are considered contributing factors to safe operations. These are commonly taught through, for example, Crew Resource Management (CRM) programs (see Salas, Wilson, Burke, & Wightman, 2006). As such training becomes more widespread, Flin et al. (2000) suggest that this aspect of the skill base may also need to be incorporated into the competence variable. The sixth theme, *procedures and rules,* did not emerge in many of the reviewed surveys. Other researchers have, however, identified this theme as an important factor (Guldenmund, 2000), and Flin et al. (2000) therefore recommend this factor included as a dimension of safety climate. Perceptions of safety rules, attitudes to rules and compliance or violation of procedures are covered by this theme.

Flin et al. (2000) suggest that further research is needed to determine these features and identify other features of organizational safety climate. They propose that other features

of the more underlying climate could be *blame* and *organizational learning*, constituting the seventh and eighth factors. These features may also prove to be better defined as a measure of culture as they can not be directly linked to behavior, however strongly determined by climate.

Measurement approaches to safety climate. Previous attempts to replicate factor structures of safety climate scales have not been entirely successful (e.g. Brown & Holmes, 1986; Dedobbeleer & Béland, 1991). If a basic factor set can be established, it must be shown to be reliable, valid, sufficiently comprehensive and theoretically justifiable.

Safety climate is, as indicated above, commonly measured through questionnaire surveys (e.g. Zohar, 2000; Zohar et al., 2005). Most empirical studies have used an aggregate unit of analysis, such as the work group, department or organization. Such climates have been operationally constructed by aggregating individual scores to the appropriate level and using the mean to represent climate at that level. The rationale behind aggregating individual data to a unit level is the assumption that organizational units have their own climate and that these can be identified through the demonstration of significant between-groups variance in climate in different units, and significant within-group agreement in perceptions within units (James, 1982, in Patterson et al., 2005, p. 380). Perceptual agreement implies a shared assignment of psychological meaning allowing individual perceptions to be aggregated and treated as a higher level construct, particularly on the group level. Most research is now focused on aggregated climate (Schneider, Browen, Ehrhart, & Holcombe, 2000).

In a study from 2005, Zohar and Luria used the Multilevel Model of Safety Climate, earlier developed by Zohar (2000, 2002) as a theoretical framework for investigating and measuring safety climate on organization and group level. The model is based on an interpretation of climate where the concept can be analyzed and measured on different organizational levels, and where perceptions or evaluations of relevant *policies, procedures,* and *practices* serve as indicators of desired climate. These indicators can vary; they are often inconsistent and contradictory. The model presupposes that employees in an organization will try to make a meaningful interpretation of the prevailing policies and procedures defined by top management which makes it easier for them to follow the bottom-line priorities at the working place. Zohar et al. (2005) infers that the core of the climate construct is determined by socially formed indications of desired role behavior, something that is expressed through policies, procedures, and supervisory actions demonstrated by personnel practices. Climate perceptions at an organizational level, with reference to established organizational policies, procedures, and top management actions are, according to this line of reasoning, implemented

and known throughout the whole organization (assuming the perception of organizational climate is homogeneous at this organizational level). Further, the perceptions of supervisory practices on group level will only be prevailing within the subunits. Assuming this conclusion is true, there will be within-groups homogeneity and between-groups variance on subunit level (group level). In order to measure safety climate in an organization, Zohar et al. (2005) suggest that data needs to be collected and compared from several organizational units operating within the same organizational level. If there is strong agreement within units at the same organizational level, it is implied that the safety climate is strong (Zohar, 2000; Zohar, 2002; Zohar et al., 2005; Schneider, Salvaggio, & Subirats, 2002).

Shipping company Fortuna's safety campaign and the Campaign Model

Fortuna's safety campaign was launched in 2002, and is still in operation. It is targeted at human factors with the purpose of raising awareness and promoting changes in attitudes and behavior among all personnel connected to the organizational network. The company's goal is to improve year by year on safety in terms of a successive reduction in the number of accidents and incidents and, to ultimately have the world's safest fleet. Accident statistics show a reduction in the number of accidents and incidents from 2002 to 2005. In 2006 there was a high increase in both number and seriousness of accidents followed by a decrease in 2007. The campaign has been developed by external parties, including a psychologist with specialization in organizational psychology, a flight pilot and a media company - all of whom are subject experts within the Norwegian community of safety-critical industries.

Fortuna's safety campaign is based on principles from the SHELL Model (Hawkins, 1987; Edwards, 1988) and Crew Resource Management (CRM) training (Salas, Burke, Bowers, & Wilson, 2001; Salas et al., 2006). The two components will briefly be addressed below.

The SHELL (software, hardware, environment, liveware, liveware) Model. The SHELL Model, originally developed by Edwards (1972, in Edwards, 1988), has its origin from the aviation industry. It is considered valuable for developing taxonomies of human error causal relationships and for studying the links existing between persons, organizations and society. It considers a basic unit made of four elements: The first resource is named *hardware* (H), and consists of physical property – buildings, equipment, vehicles, materials, and so on. The second resource, *software* (S), is much of what can be set down in a collection of documents. It comprises the rules, regulations, laws, orders, standard operating procedures, customs, practices and habits governing the manner in which the system operates and in

which the information within it is organized. Human beings make up the third resource, named *liveware* (L). The fourth resource is an additional *liveware* (L) dimension, and accounts for the fact that people interact with each other as well as with machines. It thus represents the other persons directly involved in the task environment (Edwards, 1988). According to Edwards (1988), no arrangements of hardware, software, and liveware exist in a vacuum - they will operate in the context of the *environment* (E), made up of physical, economic, political, and social factors. These environmental factors are also considered system resources, regardless of whether they are controllable or not. It is in the interface between any of these four elements that human error may occur.

Crew Resource Management (CRM) training. It is in the interface between the two liveware components in the SHELL Model that CRM training must be considered. This team training strategy is focused on improving crew coordination and performance (Salas et al., 2006). Like the SHELL Model, it originates from the aviation industry (Cacciabue, Mauri, & Owen, 2003). The training strategy refers to a set of defined cognitive and social skills: communication, teamwork, situation awareness, leadership, assertiveness, decision making and work management, which should contribute to enhanced ability to work in teams and also enhanced safety performance (Salas, Burke, Bowers, & Wilson, 2001; Hetherington et al., 2006). The training strategy is primarily targeted at human factors on the personnel level. However, as standardized frames for utilizing this training are lacking, it has been largely up to each community using CRM training to set the framework for what is to be taught and how (Salas et al., 2006). Fortuna's safety campaign is designed to enforce changes in attitudes and behaviors not only on the personnel level but also on the organizational level.

The Campaign Model. Based on the theoretical foundation for Fortuna's safety campaign outlined above, the campaign materials, and the documented efforts made to implement the campaign, the eight-factor Campaign Model has been constructed. The rationale behind constructing a model from the campaign is that it should be in a format that makes it methodically justifiable to compare to the Safety Climate Model (Flin et al., 2000). It is assumed, however, that a methodological reconversion of results for the purpose of drawing conclusions about the effect of the campaign is also possible.

The first four factors in the Campaign Model relate only to the personnel level, and include: *stress/mental capacity, fatigue, authority*, and *situation awareness*.

The following four factors relate primarily to the organizational level, but also apply to the personnel level: *Communication and blame* is the fifth factor, and aims to improve both the quantity and quality of communication between and within each organizational unit. The

means suggested for accomplishing this is shortening the distances between organizational units in terms of for example regular visits, seminars, and social gatherings. The factor is targeted at improving the sense of unity within the organizational network. The communication of a no-blame organizational atmosphere is also integrated in this factor. *Leadership* is the sixth factor and includes raising awareness about the direct power and influence leaders have over employees: Not only the leadership styles and decisions taken by leaders in top management but also leaders on lower hierarchical levels, have both a direct and indirect effect upon how policies and procedures are practiced by employees. This factor somewhat overlaps the authority factor. The seventh factor identified relates to *the team as a barrier*, and involves suggestions on how to optimize teams in the organization within and across organizational units. Key concepts here relate to knowledge management and raising awareness on how creative solutions and innovative thoughts are often promoted through teamwork. The team is seen as a barrier in line with other necessary barriers to prevent accidents and is a result of the recognition that no human is flawless and no system is perfect (Reason, 1997). This factor relates to both the personnel and the organizational level of human factors and is an important component of the model. The final factor in the model relates to an overall safety profile. It can be defined as a clear and goal directed promotion of *safety commitment* in terms of spending money and resources on improving safety. This factor relates to top management initiatives like, for example, the campaign itself, organizing safety seminars for employees on all organizational levels or, employing safety officers whose main purpose is to promote and raise awareness about human factors involved in safety. It also reflects how these initiatives are welcomed by the rest of the organization. The objectives of this factor are to educate the organization in that safety is not just created on the personnel level of the organization (the vessels). It is, rather, a result of goal-directed efforts from the whole organizational network. In that way, the success of this factor is fundamental for the progress of the entire campaign.

The above presentation of the safety campaign and the Campaign Model has been approved by its creators and by Fortuna.

Hypotheses

In his master's thesis from the University of Oslo, Straumsheim (2007) found that semi-structured interviews constructed around a SWOT-based format (Dyson, 2002; Langer, Alfirevic, Pavicic, 2005) captured more aspects of an organization's psychosocial work environment than the QPSNordic (Dallner, Elo, Gamberale, Knardal, Lindström, Skogstad, &

Ørhede, 2000, in Straumsheim, 2007) and the HSE indicator tool (Cousins, MacKay, Clarke, Kelly, Kelly, & McCraig, 2004, in Straumsheim, 2007). They are both survey instruments for measuring psychosocial work environment. Whether there is reason to believe that the same applies for the concept of safety climate, has never previously been investigated.

Interviews provide an alternative to the often used strategy of validating questionnaires through established models, a strategy that may be vulnerable to the common problem of method variance (Robson, 2002). Semi-structured interviews give an opportunity for the respondents to state what they consider critical aspects of a certain topic; here safety climate. The range of potentially important topics is to a smaller degree limited by the researcher's choice of measurement approach in interviews than in questionnaire surveys.

The SWOT analysis identifies the *strengths* and *weaknesses* in an organization, matching them with the *opportunities* and *threats* for the future. Having identified these factors, strategies are developed which are able to build on the strengths, eliminate the weaknesses, exploit the opportunities, and counter the threats (Dyson, 2002), ultimately achieving a strategic fit with reality and laying the foundation for intervention planning. The strengths and weaknesses are identified by an internal appraisal of the organization (e.g. personnel, product, services and facilities) and the opportunities and threats by an external appraisal (e.g. political, economical and competitive environment) (Langer, et al., 2005).

For the present study, the SWOT-format is considered useful for the purpose of eliciting experiences, points of views and evaluations of the safety climate and human factors within the organizational network, not only for the present situation (strengths and weaknesses), but also for the future perspective (opportunities and threats). It is expected that semi-structured interviews building on a SWOT-format will be able to elicit data that would not have been revealed through questionnaire measures. The hypotheses are as follows:

1. Semi-structured interviews based on a SWOT-format will bring forth data that reflect the eight factors in the Safety Climate Model proposed by Flin et al. (2000).
2. Based on Straumsheim's (2007) findings, it is expected that the interviews will bring fourth relevant data on safety climate, not accounted for by the Safety Climate Model proposed by Flin et al. (2000). It will be investigated whether the four human factors on the organizational level in the Campaign Model can give an account of these data and contribute to further developments of the Safety Climate Model.
3. If the Campaign Model is addressing human factors, and Fortuna's safety campaign has been successful in raising awareness, then the human factors identified in the model, should be strongly reflected in the interviews.

Method

The present study investigates the safety focus in an organizational network, not a single organization. This gives some implications as to how organizational levels are identified, and calls for an outline of the present organizational network structure. All the information about Fortuna and its organizational network presented here, has been acquired through company documents or from informants employed in Fortuna. The information has been approved by Fortuna.

Fortuna's organizational network structure

Shipping company Fortuna is one of the world's largest private owned tanker companies, owning and operating around 80 vessels mainly carrying crude oil. All vessels are technically and commercially outsourced to third party ship management companies. Fortuna has around 40 employees who are divided into a technical department, chartering department, operations department and financial department. The technical department is responsible for monitoring, approving and supporting actions taken by the ship management companies on their area of responsibility and expertise respectively. The only parts of the business not outsourced, are the trading of the vessels, i.e. the chartering department.

The ship management companies. The technical management of the vessels is outsourced to five ship management companies located around the world. These are independent companies selling services to Fortuna, this being technical management and crewing of the vessels. Since the campaign started in 2002, none of the ship management companies has left or joined the organizational network. The companies are responsible for managing the vessels in a manner that complies with international rules and regulations, rules defined by the flag state of the vessels, port state regulations, and standards defined by oil majors.

Each ship management company manages between 7 and 20 vessels each for Fortuna. These vessels compose the Fortuna fleet for each ship management company. The companies receive a fixed management fee for each vessel they manage on behalf of Fortuna. This fee covers their expenses and profit. For each vessel, an annual budget is established and Fortuna funds the ship management company monthly according to this budget. Each of the Fortuna vessels have a designated person from the ship management company, a Superintendent, to whom the crew report and who has daily contact with the vessel through telephone, e-mails and regular visits to the vessel. Superintendents are responsible for between 1 and 5 vessels

each. The Superintendents usually report to a fleet manager supervising the entire Fortuna fleet within each ship management company. These Fleet Managers further report to their designated Fleet Manager within the technical department in Fortuna. The Superintendents responsible for the vessels are the only ones in direct contact with the ship staff from the technical side on a regular basis.

In addition to technical management of a number of vessels for Fortuna, one of the ship management companies also provides post fixture services to all Fortuna vessels. This service relates to the handling of port calls as well as speed and fuel calculations. Post fixture operators monitor the voyage from the port where the vessel is loading, during the voyage and up until the vessel is finished discharging at the next port. They are in direct contact with all vessels, advising them about time, speed, and charterer's voyage orders for loading and discharging when at port, as well as bunkering operations.

The vessels and their crew. All Fortuna vessels are manned by crew provided by the ship management companies. Most of these companies have their own crewing centers - located at different places in the world - where seafarers are recruited, trained and educated. Within each ship management company, there is a pool of seafarers designated to sail only on vessels within the Fortuna fleet. The retention rates of crew vary however, depending on stability of crew supply within each ship management company respectively; crew may change employer, or they may change crew pool within the same employer. Crew supply is largely dependent on the number of vessels within the world fleet compared to the number of seafarers available in the world at any given time. At the present time, there is a general lack of seafarers within the world fleet.

A vast majority of Fortuna vessels are manned with multinational crew. The lowest ranks onboard the vessels, ratings, are primarily manned by Philippinos, whereas most officers come from former Soviet countries, Eastern Europe or India.

The vessels are manned with between 21 and 25 crew members. The Master has the overall responsibility for all departments. The top management team on the vessels includes the Master, the Chief Engineer, the Chief Officer and the Second Engineer. The Master and the Chief Engineer receive orders from the Superintendent in charge of the vessel regarding technical matters, and report back to him/her. In addition, the Master receives orders from designated post fixture operators regarding commercial matters and reports back to him/her.

For the purpose of addressing safety within this organizational network, all the organizational units described above will be involved in determining it. It is therefore necessary to construct a somewhat artificial organizational structure within this organizational

network: In the present research design, Fortuna will be regarded as top management; the five ship management companies will be defined as departments or subunits, all of them representing mid level management; and the vessels will be regarded as working units under mid level management and will from here on be referred to as the personnel level.

Participants

A structured sample of 32 informed individuals were interviewed in the period between 10.10.07 and 10.11.07. Eleven interviews were carried out among members of top management in Norway, 11 interviews among members of mid level management in Glasgow, and 10 interviews onboard one of the vessels at sea between Singapore and Dubai. The sample was selected according to four criteria: First, it should, as far as possible represent the expert knowledge present within the organizational network (Flick, 2002). Second, the number of interviewees on each organizational level should be the same. Third, the ship management company chosen to represent mid level management should represent both the technical management of the vessels and the commercial post fixture management (only one ship management company satisfied this criterion). Fourth, the chosen vessel for conducting interviews on the personnel level should be managed by the ship management company that was also represented in the sample. These criteria were established in order to minimize third-variable problems.

Ten interviewees were Norwegian, 10 British, 5 Philippino, 4 Russian, 1 Ukrainian, and 1 Australian. The interviews with Norwegian interviewees were carried out in Norwegian and the rest of the interviews were carried out in English, where only the British and the Australian interviewees were native English speakers. One interviewee was female and the rest were males. The average age was 42 years old, the youngest being 19 and the oldest 62. All participants in the study were treated in accordance with APA ethical codes (American Psychological Association, 2002).

Measures

The interviews were based on principles from SWOT analysis (Dyson, 2002; Langer et al., 2005), asking the interviewees to reflect upon safety within the organizational network, focusing on the strengths and weaknesses in the organization, and opportunities and threats in the environment as seen from their point of view.

In order to get as much information as possible out of the interviewees without leading them in any direction, a semi-structured interview format was used, asking very general and

open questions, leaving it largely up to the interviewee to decide what he/she wanted to talk about, however within the frames that the topic gives (Kvale, 1996). The introduction letter that was handed out to the interviewees before the interviews and the interview guide are presented in the appendix. In this form of interview, the interviewee is of minor interest as a person, rather it is his/her capacity of being an expert in a certain field of activity that is the center of attention. He/she is integrated into the study not as a single case but as representing a group of specific experts. The range of potentially relevant information provided by the interviewee is rather restricted (Flick, 2002, p. 89).

The same questions were asked to all interviewees and included the following: "What do you consider strengths in this organizational network regarding safety?", "What do you consider weaknesses in this organizational network regarding safety?", "Can you think of any means for improving the quality of safety in the organizational network?" and "Can you identify any problems that would prevent better safety in the organizational network?" Follow-up questions were related to what the interviewees had already been talking about and could include the following: "Could you say something more about that?", "Can you give an example?", "Can you think of anything else?", "Am I understanding you correctly in that what you are saying is…?", or "What do you mean by that?"

Procedure

Carrying out the interviews. All the interviews were carried out in the interviewees' working environment by two Master's degree students in psychology, and lasted for approximately one hour. Before each interview, the interviewees were briefed about the purpose of the interview, the format of the interview, the confidentiality of what was said during the interview and their right to withdraw from the interview at any time if they wished to do so. The interviewees were also asked whether they felt comfortable with having their interview tape-recorded. Two interviewees did not wish to be tape-recorded, and these two interviews were later excluded from further analysis. The final sample thus consisted of 30 interviewees; 10 from the top management level, 11 from mid level management and 9 from the personnel level. Finally, a consent form was signed by both interviewee and interviewers. After each interview, the interviewees were debriefed and given the opportunity to ask questions if they wanted to do so. In the interviews conducted on the personnel level, it was considered desirable that the interviewers developed a relationship of trust with the interviewees: It was suspected that the interviewees would provide untrue data if they had not trusted the interviewers. The interviewers therefore sailed for 14 days with the vessel in which

the interviewees worked, interacting with all members of the crew both during their work and spare time. After one week of sailing, the first interview was conducted.

Transcription. The interviews were transcribed by the same two persons who had carried out the interviews, sharing the transcription load equally between them. The transcription was done as carefully as possible, making sure that no information from the interviews was left out in the transcription. However, stuttering or incomplete sentences often present orally, especially when the interviewee was not speaking his/her native language, was either cut out in the transcription phase or transcribed correctly if there was no doubt as to what the interviewee had meant. Random tests were carried out by the two persons who transcribed the interviews on each other's transcription to ensure the reliability and validity of the transcription.

Analysis

Quantitative coding analysis. The transcribed interviews were coded in NVivo 7, a computer program designed to categorize qualitative data and quantify statements drawn from the data. In the first step, statements were drawn out of the interviews, coding them only as statements on a line-by-line basis (Strauss & Corbin, 1990). After this initial process, no information that could be linked to safety in any way was left in any of the interviews. The definition of a *statement* used in the coding of the interviews was as follows: "The smallest meaningful unit of a sentence or several sentences that can directly or indirectly be linked to safety". If the interviewee spoke about the same thing several times, it was coded as multiple statements as long as it was not in the same sequence of the text; sequence in this context meaning the interviewee speaking about the same topic without moving to another topic.

In the second step, the statements were coded on two categories: The first category was *organizational level,* and refers to which organizational level the statement was targeted at (four dimensions: the industry level, top management level, mid level management or personnel level). The industry level was included after it was discovered that some statements could not be linked to the organizational network directly, but was of a broader and super ordinate character. On occasions where it was unclear as to which organizational level the statement was targeted at, it was placed in only one of the relevant levels, decided after discussion and reasoning between the two coders. Statements concerning Fortuna's safety campaign were consistently coded on the top management level. The second category was *SWOT,* and refers to whether the statement could be identified as a strength, weakness, opportunity or a threat. If the statement could not be identified as a strength, weakness,

opportunity or a threat, there was also an option to code it as *not accounted for by SWOT.* All of the initial statements drawn from the interviews could however be identified as either a strength, weakness, opportunity or a threat, and this category was thus eliminated. The criterion for coding a statement as either a strength or a weakness was that the statement reflected views and opinions about the present situation and ongoing work that could directly or indirectly be linked to safety within the organizational network. The criterion for coding a statement as an opportunity or a threat was that the statement reflected views and opinions about future external or environmental factors that could directly or indirectly affect safety within the organizational network. Statements coded in either of these dimensions thus reflect primarily external factors, such as political or social, which may aid or prevent the organizational network in their work on improving safety. However, statements coded in either of these two dimensions can also represent possibilities, suggestions or obstacles for either of the units within the organizational network, identified by interviewees employed in either of the other units within the organizational network.

Inter-rater reliability in the coding of statements, SWOT and organizational levels. Thorough knowledge about the structure of Fortuna and its organizational network, the shipping industry, and the context in which the interviews had taken place, was considered necessary for a precise and correct extraction and coding of the statements. All interviews were therefore coded together by the same two persons who had carried out and transcribed the interviews according to predefined definitions. Two of the interviews were coded separately by the two raters before an inter-rater reliability of identified statements in the interview was calculated on the basis of percent agreement. The inter-rater reliability on identified statements was 71.4 %. After this, Cohen's Kappa was calculated for agreement in coding over both SWOT and organizational level for the statements identified by both raters (Bordens & Abbott, 2005). Cohen's Kappa (κ) for agreement on coding over SWOT levels was .73 and over organizational level .78. The agreement among the raters was considered satisfactory according to Baker and Gottman (1989, in Bordens & Abbott, 2005)

Data treatment in SPSS. The data from the quantitative coding analysis was plotted as variables in SPSS 16.0, a computer program for quantitative data analysis. Repeated measures ANOVA were carried out to establish main and interaction effects.

Qualitative content analysis. A content analysis of the identified statements was carried out retrospective of the quantitative coding. Statements were clustered in themes based on their content and meaning. Statements referring to similar meaning were thus clustered in

the same theme within the previously established SWOT and organizational level distribution. The themes for the clustering were developed parallel to the content analysis.

After the clustering of statements in themes based on their meaning, the clustered themes were compared qualitatively with the Safety Climate Model (Flin et al., 2000) and the Campaign Model.

Ethical considerations

Voluntary participation and informed consent. Organizational units in which the interviews were conducted, were contacted to ask if employees were willing to participate. It was informed before each interview by the interviewers, and through the informed consent form, that participation in the study was voluntary and that participants had the possibility to withdraw from the study at any time if they wished to do so. A written consent form was signed by the two interviewers and the interviewees before each interview.

The interviewers, writing their Master's thesis in connection with Fortuna, may have been regarded as representatives from Fortuna. Subjects may therefore have felt obliged to participate even though they knew that their participation was voluntary.

Anonymity. Before each interview participants were informed, both through the consent form and also verbally, that all the information gathered and used from the interviews would be treated anonymously, and that any information that could be directly linked to the interviewees would be deleted or anonymized.

Informed consent regarding the use of tape-recorder and transcription. The interviews were tape-recorded on a micro cassette player after verbal consent from interviewees. The participants were informed about the purpose of the tape-recording and that these recordings would later be transcribed by the two interviewers. They were also informed about who would have access to the recordings and the transcriptions. It was assured that the information would be treated anonymously and not made known to any other members of the organizational network and, that the information would never be used against them in any way.

Treatment of data. After the transcription and reliability testing of the transcription, the tape-recordings were erased. All data files regarding the transcriptions and the interviews were also erased. The two interviewers have one copy each of the transcriptions and have taken the full responsibility for these and any information that may be deduced from these.

Results

From the analyzed interviews (*N*=30), a total of 736 statements were identified. The distribution of statements was as follows over organizational levels: 286 (*M*=9.5, *SD*=7.3) at the top management level, 175 (*M*=5.8, *SD*=5.8) at mid level management, 196 (*M*=6.5, *SD*=4.6) at the personnel level (the vessels), and 79 statements (*M*=2.6, *SD*=3.1*)* were targeted at the industry level. The distribution of statements on the SWOT levels was as follows: 204 statements (*M*=6.8, *SD*=5.7) were coded as strengths, 276 statements (*M*=9.2, *SD*=4.8) as weaknesses, 159 statements (*M*=5.4, *SD*=4.9) as opportunities and 97 statements (*M*=3.2, *SD*=2.2) as threats.

Main effects of organizational levels and SWOT, and interaction effect between them

Main effects. A repeated measures ANOVA was conducted to establish main effects of the following factors: (a) number of statements coded in the four categories of organizational level (top management level, mid level management, personnel level and industry level) and (b) number of statements coded in the four levels of SWOT. Main effects and interaction effect are displayed in table 1. Note that eta squared is used as a measure for effect size, a measure not usually preferred (e.g. Bakeman, 2005; Olejnik & Algina, 2003). Reporting effect sizes derived from analysis of variance that include repeated measures is problematic (Bakeman, 2005), and because there is only one error term for each analysis conducted (only one main effect with four repeated measures), the effect size presented by eta squared is therefore considered satisfactory for this study.

Table 1

Main effects of organizational level and SWOT, and interaction effect between organizational level and SWOT

Factor	*df*	*F*	*sig.*	n^2
Org. level	3, 87	8.65	.000	.230
SWOT	3, 87	11.74	.000	.290
Org. level*SWOT	9, 26	6.51	.000	.183

As seen from table 1, both factors tested showed statistically significant main effects. This means that the distribution of statements between organizational levels and SWOT, when considered independently, is not coincidental. To further investigate the relationships between

dimensions within each factor, post-hoc comparisons were carried out. This gives an indication about which of the dimensions in a single factor are significantly different from each other in terms of number of statements coded on each dimension.

Post-hoc comparisons for organizational level (table 2), using paired samples t-tests, showed that the number of statements targeted at the industry level were significantly different from the number of statements targeted at the top management level, the number of statements targeted at mid level management, and the number of statements targeted at the personnel level. The number of statements targeted at the top management level was also significantly different from the number of statements targeted at mid level management. A significant difference in the number of statements targeted at two different levels indicates that the difference is of a magnitude that makes it 5 % or less likely that the difference is found by chance.

Table 2

Paired samples t-tests for organizational level

Factor	*M*	*SD*	*SE*	*t*	*df*	*Sig.*
I/TM	-6.90	7.42	1.35	-5.10	29	.000
I/MLM	-3.20	5.51	1.01	-3.18	29	.003
I/V	-3.90	6.00	1.09	-3.56	29	.001
TM/MLM	3.70	9.31	1.70	2.18	29	.038
TM/V	3.00	9.04	1.65	1.82	29	.079
MLM/V	-0.70	6.64	1.21	-0.58	29	.568

Note: TM=top management level, MLM=mid level management, V=vessel/shop floor level, and I=industry level.

Post-hoc comparisons for SWOT (table 3), using paired samples t-tests showed that the number of strengths differed significantly from the number of threats; the number of weaknesses differed significantly from the number of opportunities and the number of threats; and the number of opportunities differed significantly from the number of threats.

Table 3

Paired samples t-tests for SWOT

Factor	*M*	*SD*	*SE*	*t*	*df*	*Sig.*
S/W	-2.40	8.04	1.47	-1.64	29	.113
S/O	1.50	4.83	0.88	1.70	29	.099
S/T	3.57	5.94	1.08	3.29	29	.003
W/O	3.90	5.55	1.01	3.85	29	.001
W/T	5.97	4.46	0.81	7.33	29	.000
O/T	2.07	4.09	0.75	2.77	29	.010

Note: S=strengths, W=weaknesses, O=opportunities, and T=threats

Interaction effect. A repeated measures ANOVA analysis was carried out to reveal any interaction effect between organizational level and SWOT. The result is displayed in table 1 together with the main effects. The interaction effect showed a significant result, indicating that the effect of one of the variables changes over the levels of the other variable (Bordens et al., 2005). Figure 1 gives a graphical illustration of the interaction effect.

Most of the statements that were targeted at the top management level are strengths and weaknesses. The number of opportunities is also large, and the number of threats is notably lower. The distribution of statements targeted at the top management level on SWOT is the only organizational level where there does not seem to be a relationship between positive (strengths and opportunities) and negative (weaknesses and threats) statements. For mid level management, there seems to be a pattern in the distribution on SWOT; the number of positive statements outweighs the negative. The number of statements is also quite evenly distributed according to this premise. The number of statements targeted at the personnel level shows the most extreme differences in positive and negative statements compared to the other organizational levels, taking into account the total number of statements targeted at each organizational level. The number of weaknesses and threats are both higher than in any of the other organizational levels, and the number of strengths and opportunities are lower than both the top management level and mid level management. The industry level shows an even distribution of statements with more negative than positive statements.

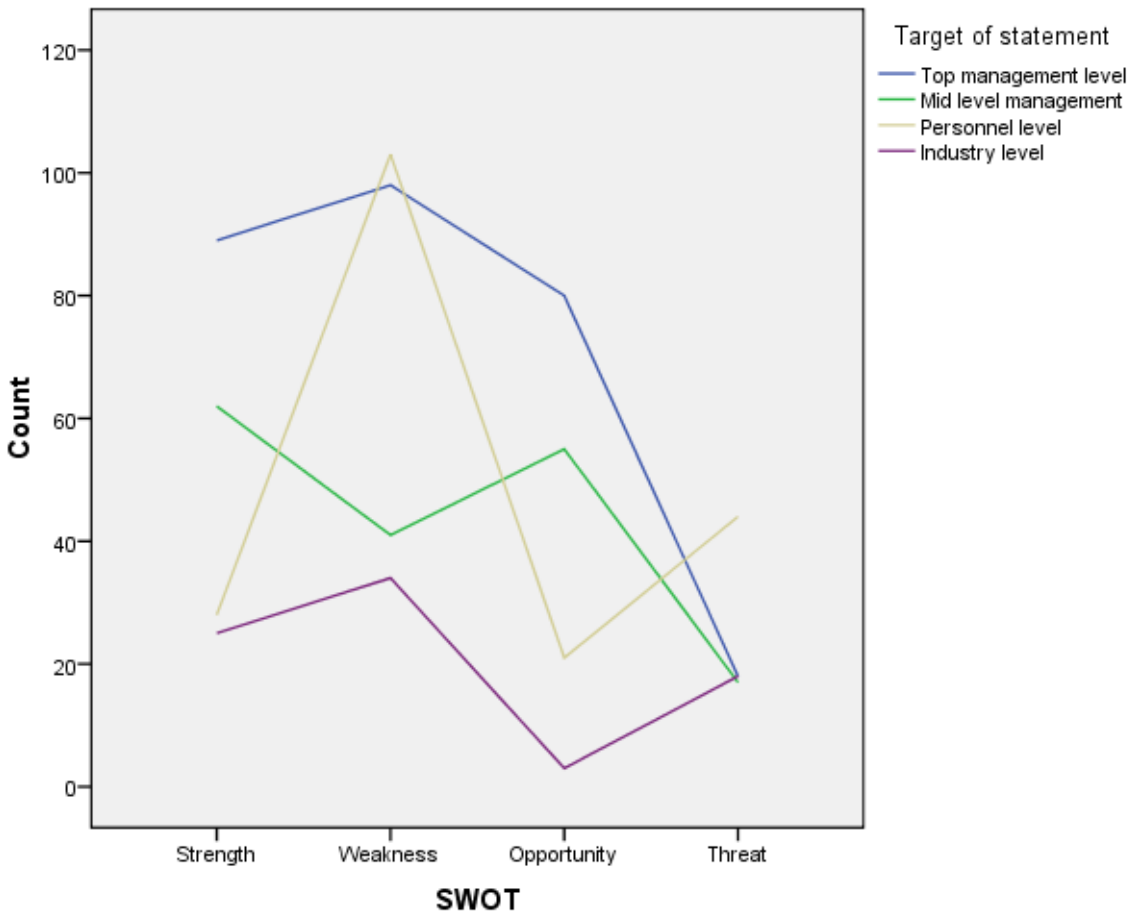

Figure 1. Number of statements over organizational levels and SWOT

Content analysis of statements on an organizational level and SWOT format, and compatibility with the Safety Climate Model and the Campaign Model

The clusters of statement content over organizational levels and SWOT levels are displayed in table 4, 5, 6, and 7. The clustered themes' compatibility with the eight factors proposed by Flin et al. (2000) to comprise safety climate and the eight dimensions in the Campaign Model are also indicated.

Table 4

Statements clustered in themes on top management level over SWOT levels

SWOT	Theme	No. Statements
Strengths		
	• Top management has pinpointed important safety aspects within the organization that has an improvement potential, and means of attaining those improvements (1)(8*)	24
	• Top management communicating clear and goal-directed commitment to improving safety throughout the organization as well as creating an open arena for feedback (1)(5*)	20
	• Concrete safety improvements within the organization as a result of management commitment (8)(8*)	14
	• Open communication and routines regarding risk assessment and misjudgements/ errors originating from top management (3)(5*)	13
	• Strong safety profile, both internally and externally, originating from top management (1)(6*)	9
	• Broad experience and solid competence in top management (5)(7*)	3
	• Top management demanding and maintaining a high technical standard onboard all vessels (2)(9*)	3
	• Top management identifying themselves directly to the sea staff (1)(5*)	2
Weaknesses		
	• Lack of safety commitment in top management (1)(8*)	30
	• Unstructured and insufficient implementation of policies originating from top management and subsequent follow-up (2)(5*)	23
	• Top management does not sufficiently consider the level of knowledge and cultural differences, or working situation of employees in lower hierarchical levels when communicating policies (2)(5*)	21
	• Top management and top management policies are not visible to lower hierarchical units within the organizational network and vice versa (1)(5*)	15
	• Top management does not include mid-level management in decision making processes and in the formulation of strategy (9)(5*)	5
	• Top management distributing blame after incidents or accidents (7)(5*)	3
	• Insufficient control over technical maintenance onboard the vessels (2)(5*)	1
Opportunities		
	• Adapting/ tailoring tasks related to improving safety to each organizational subunit/ and identifying specific tasks for commercial departments (9)(5*)	30
	• Top management must invest more on training of crew (5)(9*)	15
	• Top management should commit all employees to safety in terms of responsibility, and act accordingly (1)(6*)	12
	• Top management should invest more resources on keeping experienced and competent employees within the organizational network to build loyalty (5)(9*)	9
	• Reducing the distance between shore and sea by letting sea staff join the office for some time, and vice versa (9)(5*)	8
	• Top management providing circular letters and news to the whole organizational network (9)(5*)	5
	• Procedure for measuring safety through formal processes (2)(9*)	2
Threats		
	• Tendency of low participation, commitment and level of knowledge related to safety activities in top management (1)(8*)	8
	• Pressure from increasingly competitive demands to push safety limits (9)(8*)	4

• Cultural and linguistic problems among employees (9)(5*)	3
• Low retention rate among sea staff will make it challenging to develop structured and costly safety training (5)(9*)	2
• Difficulties in recruiting Norwegian people with sailing experience to top management (5)(9*)	2
SUM	286

Note: Numbers written in parenthesis behind each cluster theme indicate the match with the eight factors for safety climate proposed by Flin et al. (2000), where (1)=Management attitudes and behaviors, (2)=Safety systems, (3)=Risk, (4)=Work pressure, (5)=Competence, (6)=Procedures and rules, (7)=Blame, (8)=Organizational learning, (9)=Not accounted for by any of the eight factors proposed by Flin et al. (2000). Numbers with the symbol * behind them written in parenthesis behind each cluster theme indicate the match with the eight-factors Campaign Model, where (1*)=Stress/Mental capacity, (2*)=Fatigue, (3*)=Authority, (4*)=Situational awareness, (5*)=Communication and Blame, (6*)=Leadership, (7*)=The team as a barrier, (8*)=Safety commitment, and (9*)=Not accounted for by any of the eight factors in the Campaign Model.

Table 5

Statements clustered in themes on mid level management level over different SWOT levels

SWOT	Theme	No. Statements
Strengths		
	• Good communication and support from mid-level management to vessels (including no-blame) (7)(5*)	24
	• Communicating and practicing safety policies originating from top management in the rest of the organizational network (adapting procedures to its audience) (2)(5*)	20
	• Initiating tactics to improve safety (seminars, visits to vessels, feedback from vessels, accident investigation) (1)(8*)	10
	• High standards regarding education and experience requirements for employees at sea and ashore (5)(9*)	9
Weaknesses		
	• Problems with supplying crew, information and equipment to the vessels (crew shortage and restricted budgets) (5)(9*)	15
	• Putting too much workload on sea and shore staff in terms of unuseful paperwork and reporting, and too long contracts (4)(7*)	11
	• Sea staff having difficulties identifying with the ship management company they belong to (9)(5*)	5
	• Putting blame on sea staff on occasions where correct action has not been taken (7)(5*)	3
	• Inexperienced employees in mid level management (5)(9*)	3
	• Conflicting commitments to follow policies and procedures from several ship owners (top management) (9)(8*)	2
Opportunities		
	• Strengthening sea staff in terms of: more crew, stable crew, quality crew training, and improvements in technology (5)(9*)	24
	• Strengthening the relationship between sea and shore side of the organizational network to make sea staff indentify with the organization (visiting the vessels, permanent contracts, and having sea staff in the office) (9)(8*)	15

	• Simplifying rules and regulations so that they can be understood as procedures that are possible to follow (2)(5*)	7
	• Creating an open environment for sharing information throughout the organizational network (9)(5*)	6
	• Putting pressure on regulatory bodies to improve working conditions at sea and reduce pressure on actors in the industry (6)(9*)	2
Threats		
	• Overall competence level of sea and shore staff in the international market is decreasing as well as a general lack of sea staff because the market is increasing very rapidly (5)(9*)	14
	• Being in a buffer position between top management demands and shop floor practices makes it difficult to live by a no-blame culture in practice (7)(5*)	2
	• Safety is one of the first and easiest factors to compromise in times of financial/ economical recessions and commercial pressure (1/4)(8*)	2
	• Overall workload for mid level management and sea staff is continuously increasing (4)(7*)	1
SUM		175

Note: Numbers written in parenthesis behind each cluster theme indicate the same as in table 4. Numbers with the symbol * behind them written in parenthesis behind each cluster theme indicate the same as in table 4.

Table 6

Statements clustered in themes on the personnel level over different SWOT levels

SWOT	Theme	No. Statements
Strengths		
	• Sea staff read and discuss safety rules and regulations, and apply them in their daily work (2)(8*)	13
	• Free flow of communication between all ranks onboard the vessel (9)(5*)	6
	• Competence level among senior officers in terms of experience and education is high (5)(9*)	4
	• Sea staff report all problems and issues to the shore office (open dialogue) (9)(5*)	2
	• Indications of situational awareness among sea staff (8)(4*)	2
	• Loyalty towards the ship owner (9)(9*)	1
Weaknesses		
	• Lack of education, experience, and high turnover in rank among sea staff (especially junior ranks and ratings) (5)(9*)	25
	• Workload is too high for sea staff in terms of: too much paperwork, breaking work and rest hours regulations, work environment being psychologically challenging, commercial pressure, number of crew (4)(1*)	23
	• Hesitation to confront superiors about safety issues when safety rules are ignored (9)(3*)	16
	• Level of English is very poor among sea staff, and cultural barriers are high (9)(5*)	16
	• Failure to comply with safety rules, and subsequent risk taking in situations where risk is high (3)(4*)	14
	• Lack of work engagement/ work morale among ratings in terms of professionalism and loyalty (9)(7*)	9

Opportunities		
	• Reducing the traditional authoritative leadership hierarchy onboard in order to improve communication and team efficiency (9)(3*)	10
	• Increasing the number of staff onboard the vessels as well as better utilisation of the existing workforce (4)(7*)	8
	• Better planning ahead of operations (6)(4*)	2
	• Shorter contracts, and permanent contracts for sea staff (4)(9*)	1
Threats		
	• Workload is too high on all crew, especially when at port (commercial pressure, and inspections) (4)(1*)	14
	• With a rapidly growing market, crew language competence, education and experience is increasingly compromised, and retention rate is going down (5)(9*)	14
	• Responsibility among crew is concentrated to certain senior ranks, reinforcing unhealthy authority (9)(3*)	12
	• Paperwork and other forms of reporting take the focus of the crew away from safety (4)(7*)	4
SUM		196

Note: Numbers written in parenthesis behind each cluster theme indicate the same as in table 4. Numbers with the symbol * behind them written in parenthesis behind each cluster theme indicate the same as in table 4.

Table 7

Statements clustered in themes on industry level over different SWOT levels

SWOT	Theme	No. Statements
Strengths		
	• Well established international safety routines (6)(9*)	10
	• Strict requirements regarding technical quality onboard the vessels (safety equipment) (6)(9*)	7
	• Regular assessments and audits of ship owners, ship management companies, and vessels by representatives of the industry and oil- majors (6)(5*)	5
	• Very large commercial/ economical consequences if safety is bypassed and if accidents occur (9)(9*)	3
Weaknesses		
	• The market is growing faster than the education of new seafarers (5)(9*)	14
	• New rules and regulations regarding safety creates more extra work than it enhances safety (6)(9*)	9
	• Safety systems tend to be written as an reaction to an incident (2)(9*)	9
	• The margins for profit and loss are very small, forcing actors in the industry to take shortcuts (9)(8*)	4
Opportunities		
	• The industry must focus on making rules and regulations that will enhance the quality of crew (5)(9*)	3
Threats		
	• Shortage of quality seafarers, both ashore and at sea (5)(9*)	10

• When the oil market is good, safety requirements will be compromised by oil majors and ship owners (9)(8*)	5
SUM	79

Note: Numbers written in parenthesis behind each cluster theme indicate the same as in table 4. Numbers with the symbol * behind them written in parenthesis behind each cluster theme indicate the same as in table 4.

Compatibility of the clustered themes with the Safety Climate Model. The clusters of statements developed in the content analysis (table 4-7) were compared qualitatively to the Safety Climate Model (Flin et al., 2000). A summary of the results is displayed in table 8.

Table 8

Distribution of statements over the factors in the Safety Climate Model and organizational levels

	TM	MLM	P	I	Sum	% accounted for
Management attitudes	120	12	0	0	132	17.9
Safety systems	50	27	13	9	99	13.5
Risk	13	0	14	0	27	3.7
Work pressure	0	12	50	0	62	8.4
Competence	31	65	43	27	166	22.6
Procedures/ rules	0	2	2	31	35	4.8
Blame	3	29	0	0	32	4.4
Organisational learning	14	0	2	0	16	2.2
Not accounted for	55	28	72	12	167	22.7
Sum	286	175	196	79	736	100.0

Note: TM=top management level, MLM=mid level management, P=personnel level/vessel, and I=industry level.

Compatibility of clustered themes with the Campaign Model. The clusters of statements developed in the content analysis (table 4-7) were compared qualitatively to the Campaign Model derived from Fortuna's safety campaign. A summary of the results are displayed in table 9. As outlined above, only four of these factors, relating to human factors on the organizational level, are of particular interest for the purpose of comparing the Campaign Model to the Safety Climate Model (Flin et al., 2000). Note therefore that the four factors relating to the personnel level have been aggregated in table 9.

Table 9

Distribution of statements over organizational level and the Campaign Model

	TM	MLM	P	I	Sum	% accounted for
The four personnel factors*	0	0	93	0	93	12.6
Communication	149	67	24	5	245	33.3
Leadership	21	0	0	0	21	2.8
Team	3	12	21	0	36	4.9
Safety commitment	80	29	13	9	131	17.8
Not accounted for	33	67	45	65	210	28.5
Sum	286	175	196	79	736	100.0

Note: TM=top management level, MLM=mid level management, P=personnel level/vessel, and I=industry level. *=The four human factors on the personnel level are aggregated in this table as they are of less interest for the comparison between the Campaign Model and the Safety Climate Model.

An account for the statements that did not reflect the Safety Climate Model. 21 clustered themes representing 22.7 % of the statements did not reflect any of the eight dimensions of the Safety Climate Model (Flin et al., 2000). Ten of these themes (47.6 % of the statements that were not accounted for by the Safety Climate Model) reflected the communication dimension in the Campaign Model. Five of these themes (23.8 %) reflected the dimension safety commitment in the Campaign Model. Three of these themes (14.3 %) reflect the authority dimension in the Campaign Model. As the authority dimension in the Campaign Model is considered a human factor on the personnel level, it is quite natural that this theme will not reflect the Safety Climate Model, as safety climate must be seen in connection with human factors on the organizational level. Only two of these themes (9.5 %) did not reflect either of the two models, neither the Safety Climate Model, nor the Campaign Model.

An account for the statements that did not reflect the Campaign Model. Twenty-five clustered themes, representing 28.5 % of the statements, did not reflect any of the eight dimensions in the Campaign Model. These statements are largely concerned with the competence, educational level and degree of experience among members of the organizational network: 77.6 % of the statements that did not reflect any of the eight factors in the Campaign Model were reflected in the competence dimension of Flin et al.'s (2000) Safety Climate Model.

Discussion

Summary of key results

The first hypothesis of this study was that semi-structured interviews in a SWOT-based format, asking general questions about safety, would produce information that reflects the chosen model for safety climate (Flin et al., 2000). The data was in agreement with the hypothesis: 77.3 % of all the identified statements were compatible to one of the eight factors in the model. All the factors were represented among the statements. The second hypothesis was that the interviews would bring fourth relevant data on safety climate, not accounted for by the Safety Climate Model (Flin et al., 2000). The data was also in agreement with this hypothesis: 22.7 % of the statements did not reflect any of the eight factors in the Safety Climate Model. Of these statements, 47.6 % of them were related to the communication dimension in the Campaign Model. The third hypothesis was related to the Campaign Model and its success in raising awareness on human factors in Fortuna. It was found that the members of the organizational network's safety focus, to a large degree, reflected the Campaign Model: 71.5 % of the identified statements were related to one of the dimensions in the Campaign Model. A causal relationship between the organizational network's safety focus and the Campaign Model can not be implied, but the results argue in favor of a continuation of Fortuna's safety campaign from which the Campaign Model is derived.

Quantitative results

Organizational level. The results showed that there was a significant main effect of the number of statements coded over the four organizational levels. Post-hoc analysis showed that the industry level was significantly different from all other organizational levels. The industry level was, as outlined above, only included to account for the statements that were related to safety and were not possible to categorize within either of the other organizational levels. It should be considered a rest category and it is therefore not surprising that the industry level is different from the other organizational levels regarding the number of statements. Through the content analysis it was further established that these statements were also different regarding content: The statements were largely concerned with premises for safety defined by national and international rules and regulations in the shipping industry. They are therefore beyond the control of Fortuna, assuming that rules and regulations are followed and, accordingly, are also outside the scope of the present study.

The top management level was significantly different from mid level management. None of the other organizational levels, except the industry level, were significantly different from each other. This finding suggests that the statements are quite evenly distributed over the three organizational levels representing the organizational network in the present study (top management level, mid level management and personnel level). Any differences between these organizational levels in the distribution of statements over the SWOT categories can consequently not be attributed to large differences in the total number of statements coded on these organizational levels.

SWOT. There was a significant main effect of the number of statements coded over the four levels of SWOT. Overall, more statements were coded on the present perspective (strengths and weaknesses) than on the future perspective (opportunities and threats). A combination of categories into present and future categories might therefore have been useful for the interpretation of the analysis. However, the post-hoc comparisons between the four categories revealed that there was a significant difference between number of opportunities and number of threats, and that the number of statements coded as strengths and the number of statements coded as opportunities were not significantly different from each other. The categories were therefore kept in their original form.

The number of weaknesses outweighed the number of strengths overall, although the difference was not significant. This finding is striking as it is often found when conducting organizational research that employees fail to acknowledge the negative aspects of their own organization and show a resistance to change (Argyris, 1990).

Interaction between organizational level and SWOT. The interaction effect between organizational levels and SWOT revealed that the top management level received more statements about the present (strengths and weaknesses) compared to the other organizational levels. This may reflect the fact that the statements regarding employees' satisfaction with the safety campaign were consistently coded on the top management level. Further, mid level management was the only organizational level where, overall, more positive (strengths and opportunities) than negative (weaknesses and threats) statements were identified. On the personnel level, the number of weaknesses was much higher than all the other SWOT categories. The number of weaknesses on the personnel level was also higher than on any of the other organizational levels. This finding may have two explanations: First, it may be that the high frequency of weaknesses on the personnel level reflects reality; the largest safety challenges lies on the personnel level. Second, the high frequency of weaknesses on the personnel level may also indicate that there is a general tendency in the organizational

network to attribute human factors to the personnel level and a failure to acknowledge human factors on the organizational level. The answer may also lie somewhere in the middle. The content analysis of the interviews revealed that 77.3 % of the statements were related to the Safety Climate Model (concerning human factors on the organizational level) and that 71.5 % of the statements were related to the Campaign Model (where four of the factors concern human factors on the organizational level). These findings appear to be contradictory to the above suggested explanations. A plausible interpretation might be that human factors relating to the organizational level were attributed to the personnel level on occasions where they were considered weaknesses. If the latter is true, then it is debatable whether organizational learning has taken place in the organizational network. It is often the case that the responsibility for safety is placed on the personnel level (Argyris, 1990).

Measurement approaches to safety climate

The most frequently represented dimension in the Safety Climate Model was competence (22.6 % of the statements), the second most frequent dimension was management attitudes and behaviors (17.8 %), the third most frequent dimension was safety systems (13.5 %), and the fourth most frequent dimension was work pressure (8.6 %). Except for the high proportion of statements in the competence dimensions, the results are consistent with what Flin et al. (2000) found in their review of the research that has attempted to establish safety climate factor structures: Three of the four strongest dimensions in the present interviews are indicated by Flin et al. (2000) to be the most frequently included dimensions in their review.

The most frequent dimension in the present study, competence, was not found in a large amount of the surveys reviewed by Flin et al. (2000). As stated in the theoretical framework, Flin et al. found this dimension likely to be influenced by broader economic conditions such as labor market and training budgets. They also suggest that an increasing emphasis on competence in non-technical skills may also be included in this factor. Since the beginning of the 21st century, the shipping industry has been struggling with a shortage of qualified and experienced seafarers on the global market, and this problem is currently reaching a peak. Furthermore, through it safety campaign targeted at human factors, Fortuna has expressed an increased emphasis on and appreciation of competence in non-technical skills. It is therefore presumed that this dimension is important for both the actors in the shipping industry in general and for members of Fortuna's organizational network specifically at the present moment.

Two dimensions in the Safety Climate Model were proposed by Flin et al. (2000) as possible dimensions involved in the more underlying safety climate: blame and organizational learning. In the present study, blame accounted for 4.7 % of the total amount of statements, and was also included in the Campaign Model in the communication and blame dimension. Organizational learning accounted for 2.2 % of the statements. This study did not provide support for Flin et al.'s (2000) proposal to include these two dimensions in the safety climate construct. However, more research is needed to establish these factors' future existence in the safety climate construct.

The results indicate that the data gathered through semi-structured interviews is indeed related to safety climate, as defined in the Safety Climate Model proposed by Flin et al. (2000).

Quantitative surveys are the common measurement approach in modern research on safety climate. This approach is challenging with respect to identifying core components of the construct and pinpointing means of studying them. It is not constructed to register organization-specific aspects that may be involved in determining the safety climate. Transforming the multifaceted and partly subjective phenomenon of safety to a quantitative size will hardly capture more than bits and pieces of the whole. In some cases, the aspects of the construct that remain unstudied and unaccounted for may be of such importance that an amputated picture is constructed of the total phenomenon. In those cases, it should be considered whether a qualitative reflection of the construct, where the complexity can only be suspected and indicated, will be more valuable. Schneider (2000) suggests that when attempting to study the underlying atmosphere in organizations such as the safety climate, restricting what one can find by predefined dimensions using questionnaire surveys or rigidly structured interview guides, will most probably not uncover the complexity of the construct.

It is important to acknowledge that changing the safety climate in organizations is an approach to changing effectiveness (Schneider, 2000). Safe operations will be of interest to the extent that it lets the actor operate in the desired market: The actor has to live up to required safety standards formulated through laws and regulations designed to protect the crew, the cargo, and the environment. Safe operations will further be of interest if, on a short or a long term basis, it can be proven profitable and efficient for the actor through fewer accidents or oil spills, lower maintenance costs, or provide other commercial advantages. Only if it can be demonstrated that the safety climate is a constraint for efficiency, a change program should be launched (Schneider, 2000). The present study argues that proving the

safety climate to be a constraint for efficiency in an organization, requires more thorough and deeper investigations than can be given through a questionnaire survey.

Research has shown that interviews in many cases will facilitate reflection upon knowledge that would otherwise remain silent in interviewees' cognition (West, Hirst, Richter, & Shipton, 2004; Kazama, Forster, Hebl, West, & Dawson, 2002). These reflections may alone contribute to raising awareness on the phenomenon of interest, in this case human factors and safety climate, because the knowledge is made conscious and structured. This advantage of interviews would be of great value to anyone who wants to improve safety climate within an organization. The SWOT-format of the interviews must in this respect be seen as a tool to facilitate and assist reflection on all aspects of the phenomenon under investigation.

Hypothesis one is supported: A qualitative semi-structured interview approach is recommended for collecting data on safety climate on the basis of the present results. The SWOT-based format of the interviews and the coding of statements in SWOT categories seem sensitive to data concerning safety climate and human factors. Converting qualitative interview data to a quantitative, measurable form in NVivo 7 has also provided important dimensions to the study, utilizing advantages from both quantitative and qualitative research approaches.

The effect of Fortuna's safety campaign

Clustered themes of statements reflecting the four personnel level categories in the Campaign Model (14.9 %), were only identified on the personnel level, accounting for 47.4 % of the statements coded on this organizational level. This indicates that the factors are indeed related to the personnel level, as identified. They did not account for a substantial amount of the statements overall, however, suggesting that only to a limited extent, do they give an account for the safety focus of the organizational network.

The four human factors on the organizational level in the Campaign Model accounted for 58.8 % of the identified statements. Communication was the strongest dimension (33.3 %) and safety commitment was the second strongest dimension (17.8 %).

The Campaign Model accounted for a substantial amount of the statements identified. There may be several reasons for this finding. One possibility is that the campaign has been successful in raising awareness about human factors, particularly on the organizational level. As there are no sources of data about attitudes toward safety in the organizational network before the campaign was launched in 2002, it is difficult to be conclusive about any

explanations for the present safety focus within the organizational network. However, the higher than expected frequency of future reflections in the SWOT coding, speaks in favor of the possibility that the campaign has been successful in raising awareness of human factors: It is expected that any campaign provides clear and goal-directed suggestions for the future (Conner & Norman, 2005). Accordingly, members of an organization who have their goals for the future manifested in a campaign, for example, would be expected to reflect more often upon the future than members of an organization where future goals are less explicitly expressed.

Another finding that speaks in favor of the campaign's effect in raising awareness is the overall high degree of statements that were reflected in the Campaign Model and the Safety Climate Model. This finding is interesting for two reasons: First, it points to a high degree of reflection among members of the organizational network on dimensions of their working situation that are quite abstract and complex. Many studies have suggested (e.g. Reynolds, Sinatra, & Jetton, 1996) that the level of reflection is generally low among individuals with poor education, and that it increases with years of education. Second, in the eastern part of the world (eastern Europe and Asia), organizational climate is not - to the same degree as in the Western world - acknowledged as an important component involved in efficiency, creativity, production and safety (Lamvik, 2002). In these, often collectivistic cultures, psychological well-being of people and organizations are perhaps understood differently from what is the Western tradition (Hogg & Vaughan, 2005). With the large diversity in educational level (from no education to high education) and line of work, as well as the cultural diversity among the interviewees, it is impressive and surprising that the level of reflection on this area is as high as it is.

The method and the data of the present study do not allow for an establishment of a causal relationship between Fortuna's safety campaign and the safety focus within the organizational network. Many reasons may be used to explain the present safety focus among the interviewed subjects. Regardless, the safety focus in the organizational network does reflect the Campaign Model, and accordingly, also Fortuna's safety campaign. This finding speaks in favor of a continuation of the safety campaign in Fortuna. Hypothesis three is answered: the Campaign Model is strongly reflected in the interviews.

Suggestions for further developments of the Safety Climate Model

Through the content analysis of the data and subsequent clustering of statements in themes, it was found that 22.7 % of the identified statements from the interviews were not

accounted for by the Safety Climate Model (Flin et al., 2000). Nearly half of these (47.6 %) were accounted for through one of the human factors on the organizational level in the Campaign Model: the communication and blame dimension. This dimension refers to the shortening of communication lines within the organizational network and establishing a sense of unity and loyalty among the members. It is further concerned with the distribution of blame within the organizational network. Blame is also one of the dimensions in the Safety Climate Model. The statements that did not reflect this model are therefore concerned with the communication aspect in the communication and blame dimension. This finding provides support for arguing that communication is an important determiner for human factors on the organizational level. If it is true that human factors on the organizational level and safety climate are strongly related constructs, then communication may be an important determiner for safety climate within the present organizational network.

The structure of the present organizational network is complex. Each of the organizational levels identified for the purpose of the study (top management level, mid level management, personnel level and industry level), are in reality independent organizations, but with strong influence upon each other's business and operation. The Safety Climate Model proposed by Flin et al. (2000) may not be designed with the purpose of addressing safety climate within an organizational network as complex as the present. A consistent safety climate may be harder to identify within such an organizational structure because there are many more factors that may influence each organizational unit than it is in a single organization with a straight forward structure. In the present organizational network, for example, each ship management company (identified as mid level management in this study) probably have their own safety climates, determined by organizational aspects beyond Fortuna's control and influence. The large proportion of reflections around communication in the present organizational network may indicate that communication, as defined in the Campaign Model, is particularly important for complex organizational network structures like the present. Assuming this to be true, researchers must specify for which organizational structures the safety climate construct applies. Safety climate models constructed for specific organizational structures or specific industries may be a way of minimizing the source of error for safety climate models that lies in the uniqueness of every organization and organizational structure.

On the other hand, objective measures of safety performance can only be measured in relation to other's safety performance: In order to become "the world's safest fleet", as is

Fortuna's vision, a comparison to other shipping companies is necessary. Global measures of safety climate might prove valuable for comparisons and benchmarking.

The Safety Climate Model (Flin et al., 2000) is neither industry, nor structure specific. If such a global safety climate construct is preferred, it should, on the basis of the present findings, be considered whether communication, as defined in the Campaign Model, should be included as an additional dimension in the Safety Climate Model. Hypothesis two is supported by the above suggestion of communication as an additional dimension in the Safety Climate Model.

Validity and reliability of the results

Validity is often defined with the question: Are you measuring what you think you are measuring (Kvale, 1996)? If measuring in this context requires numbers, then qualitative research can not answer this question if it does not result in exact values. In a broader meaning of the concept, validity can refer to the degree that a method investigates what it is intended to investigate, to "the extent to which our observations indeed reflect the phenomena or variables of interest to us" (Pervin, 1984, p. 48, in Kvale, 1996). Within this wider conception of validity, qualitative research can lead to valid scientific knowledge.

The interviews. When performing interviews, data is established in a relationship between the interviewers and the interviewee based on the questions that are put forward (Flick, 2002). Other questions might have established different empirical data and results. The internal validity of the data from the present interviews can be recognized on the basis of preference for method and subsequent interpretation of the data.

All interviews carried out on the personnel level were done so in the interviewees' second or third language. All of these interviews were affected by language difficulties with the implication that reflection on the personnel level might have been impaired because of these problems. The validity of the data is weakened from these language issues.

The sample. A representative sample was not easy to reach by any medium. Only one organizational unit from each organizational level was therefore included in the study. The sample criteria were established to exclude third-variable problems that could have arisen if no direct communication line between the personnel level and mid level management had existed. An implication of this is that the results represent only this communication line, and the external validity is therefore low. The results are nevertheless valuable as a point of reference in developing hypotheses for future quantitative or qualitative contributions to safety climate research.

The sample size in the present study must be seen in relation to the practical constraints and time limitations of a Master's thesis as well as the transient nature of the population to be studied. The sample on each organizational level was 10 +/- 1 (in total, *N*=30). Measuring the safety climate within the organizational network would have required a larger sample size and subjects from different organizational units within the same organizational level (Zohar, 2002; Zohar, 2004; Zohar, 2005). The exploratory purpose of the present study allows for a smaller sample size, thus the size is therefore considered large enough to answer the study's hypotheses.

Organizational levels. It is debatable whether the chosen division of organizational levels gives the best reflection of reality. Some studies on safety climate (e.g. Zohar et al., 2005) suggest, for example, a separation of shop-floor supervisors and shop-floor employees. Whether shop-floor supervisors in the present organizational network should then reflect the top officers onboard the vessels or the Superintendents employed in the ship management companies, is an obvious question. This question of definition has been solved in the present study by defining organizational levels that are physically separated and represent distinct units (top management=Fortuna, mid level management=the ship management companies, and personnel level=the vessels). In the coding of the statements over organizational levels, additional organizational levels, or a more sophisticated definition of organizational levels, would likely have given a larger source of error as it would have been more difficult to interpret what organizational level the statements were targeted at.

The Campaign Model. The Campaign Model was constructed based on Fortuna's safety campaign. The validity of this construction should not be questioned as the campaign is very clear on its objectives. The pragmatic validity, or the degree to which the results of the study are helpful for Fortuna to improve safety, is certainly increased by including this model in the study: First, the model represents what the organization itself has identified as important aspects of the human element in safety. This premise should always be taken into account when doing organizational research. Second, as stated above, no research exists in a vacuum. Drawing methodological and theoretical inferences from the research carried out in Fortuna's organizational network would not have given valid results if the applied attempts to improve safety had not been taken into consideration for the study. Third, by relating the results to a safety paradigm already known to the members of the organizational network, the practical value will assumingly be greater for its members and for the future improvements of the campaign.

Data analysis. The findings of this study are based on interview data analyzed in both a quantitative and qualitative manner. A framework for analyzing interview data quantitatively has been used in an attempt to rise above the opinionated results often established through qualitative analysis approaches. Precise relationships have indeed been established. However, the present quantitative contribution is best understood if it is seen in relation to the qualitative data. It is not possible to establish precise relationships between variables are in qualitative data. The qualitative contribution is nevertheless of great value for the conclusions of this study. The validity of the present results must be considered with this in mind. If conclusions based on quantitative data and quantitative analyses are preferred, these results can nevertheless provide valuable indications and suggestions for future quantitative research on the concept of safety climate.

Suggestions for further research

Very few published empirical studies – if any - have applied the principles from SWOT analysis as a tool for generating data from interviews. The only located research contributions on this particular methodological area are two unpublished Master's theses from the Department of Psychology, University of Oslo (Edvardsen, 2007; Straumsheim, 2007) on organizational citizenship behavior and psychosocial work environment, respectively. Only Straumsheim (2007) found the SWOT-based interview format and subsequent coding of statements over SWOT categories to be sensitive for data regarding psychosocial work environment. More research is therefore needed to determine the SWOT-based format's sensitivity for data on safety climate and human factors, as well as other dimensions of organizational culture and climate.

Further research is also needed to validate the communication dimension in the construct of safety climate, both on the global, industry and/or organizational structure-specific levels.

The statements extracted from the interviews were not coded according to which organizational level they originated from. The position of the interviewee who postulated the statements was not included in the analysis because the variable would not have been of particular value for the purpose of answering the hypotheses. By including this variable in future studies, the following questions could for example have been answered: What organizational level does the top management level regard as the weakest level? Is there a tendency for blaming each other for the weaknesses in the organization and taking the credit for the strengths?

The safety climate in Fortuna has not been measured in the present study. Measuring the safety climate within the organizational network would require data from several organizational units on the same organizational level. Together with an evaluation of Fortuna's safety campaign, this may provide valuable guidelines for the next step in Fortuna's efforts to improve safety.

Conclusion

Based on the findings of this study, it is argued that a precise indication of the safety climate in organizations will be obtained through interviews. The complexity of the safety climate construct makes it vulnerable to influence from the political and economical environment and interviews are able to account for these changing aspects of the safety climate construct. Further, a SWOT-based interview format seems to be sensitive to information concerning safety climate.

The interviews carried out in this study were able to bring forth reflections on all dimensions of the Safety Climate Model (Flin et al., 2000) and more. The reflections found in the interviews that did not reflect any of the dimensions of the Safety Climate Model, were largely related to communication. Further research is needed to determine whether communication, as defined in the Campaign Model, should be included in a global model for safety climate.

The results of this study showed that the overall level of awareness on human factors and safety climate was high in the organizational network, a finding that can be attributed to Fortuna's safety campaign. A conclusion about the effectiveness of the campaign is impossible to draw but the results indicate that a continuation of the safety campaign project in Fortuna will bring the company closer to its goal of becoming "the world's safest fleet".

References

American Psychological Association. (2002). *Publication Manual.* Washington, DC: American Psychological Association

Argyris, C. (1990). *Overcoming organizational defencess: Facilitating organizational learning.* New Jersey: Prentice Hall.

Ashkanasy, N. M., Wilderom, C. P. M., & Peterson, M. F. (2000). *Handbook of organizational culture and climate.* London: Sage

Bordens, K. S., & Abbott, B. B. (2005). *Research Design and Methods: A Process Approach.* 6th Ed. New York: McGraw-Hill.

Bakeman, R. (2005). Reccomended effect size statistics for repeated measures designs. *Behavior Research Methods, 37*(3). 379-384.

Brown, R. L., & Holmes, H. (1986). The use of a factor-analytic procedure for assessing the validity of an employee Safety Climate Model. *Accident analysis and prevention, 18*(6). 455-470.

Cacciabue, P. C, Mauri, C., & Owen, D. (2003). The development of a model and simulation of an aviation maintenance technician task performance. *Cognition, Technology & Work, 5.* 229-247.

Conner, M., & Norman, P (Eds.) (2005). *Predicting Health Behaviour.* England: Open University Press.

Dedobbeleer, N., & Béland, F. (1991). A safety climate measure for construction sites. *Journal of Safety Research 22,* 97-103.

Dyson, R. G. (2002). Strategic development and SWOT analysis at the University of Warwick. *European Journal of Operational Research 152,* 631-640.

Edvardsen, T. H. (2007). *Evaluering av IA-arbeidet basert på samtale med ledere og stabsansatte.* Unpublished master's thesis, University of Oslo, Norway.

Edwards, E. (1988). Introductory overview. In E. L. Wiener & D. C. Nagel (Eds.), *Human Factors in Aviation* (pp. 3-24). San Diego, California: Academic Press, Inc.

Encyclopedia of Earth WWW, Exxon Valdez oil spill. Retrieved March 12, 2008, from http://www.eoearth.org/article/Exxon_Valdez_oil_spill

Flick, U. (2002). *An Introduction to Qualitative Research.* 2nd Ed. London: Sage Publications, Ltd.

Flin, R., Mearns, K., O'Conor, P, & Bryden, R. (2000). Measuring safety climate: identifying the common features. *Safety Science 34,* 177-192.

Guldenmund, F. W. (2000). The nature of safety culture: a review of theory and research. *Safety Science, 34.* 215-257.

Hale, A. R. (2000). Culture's confusions (editorial). *Safety Science, 34.*1-14.

Hawkins, F. H. (1987). *Human Factors in Flight.* England: Ashgate Publishing Ltd.

Hetherington, C., Flin, R., & Mearns, K. (2006). Safety in shipping: The human element. *Journal of Safety Research, 37*, 401-411.

Hogg, M. A., & Vaughan, G. M. (2005). *Social Psychology.* Essex, England: Pearson Education Limited.

Kazama, S., Forster, J., Hebl, M, West, M., & Dawson, J. (2002, August). *Impacting Climate for Innovation: Can CEOs make a difference?* Paper presented at the 17th annual conference of the society for industrial and organizationl psychology, Toronto, Canada.

Kvale, S. (1996). *An Introduction to Qualitative Research Interviewing.* California: Sage Publications, Inc.

Lamvik, G. N. (2002). *The Filipino Seafarer – a Life Between Sacrifice and Shopping.* Trondheim: NTNU

Langer, J., Alfirevic, N., & Pavicic, J. (2005). Selected tools for changing organizations. In K. Morita (Ed.), *Organizational Changes in Transition Societies* (pp. 157-166). Japan: Faculty of Economics, Hiroshima University.

Mearns, K., Whitaker, S. M., Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science 41*(8), 641-680.

Olejnik, S., & Algina, J. (2003). Generalized eta and omega squared statistics: Measures of effect size for some common reseach designs. *Psychological Methods, 8*(4). 438-447.

Patterson, M. G., West, M. A., Shackleton, V. J., Dawson, J. F., Lawthom, R., Maitlis, S., Robinson, D. L., & Wallace, A. M. (2005). Validating the organizational climate measure: links to managerial practices, productivity and innovation. *Journal of Organizational Behavior, 26*, 379-408.

Perrow, C. (1999). *Normal Accidents: Living with High-Risk Technologies.* New Jersey: Princeton University Press.

Reason, J. (1997). *Managing the Risks of Organizational Accidents.* England: Ashgate Publishing Limited.

Reynolds, R. E., Sinatra, G. M., & Jetton, T. L. (1996). Views of knowledge acquisition and representation: A continuum from experience centered to mind centered. *Educational Psychologist, 31*(2), 93-104.

Robson, C. (2002). *Real World Research* (2 ed.). Oxford: Blackwell Publishing.

Salas, E., Burke, C. S., Bowers, C. A., & Wilson, K. A. (2001). Team training in the skies: Does crew resource management (CRM) training work? *Human Factors, 43*(4), 641-674.

Salas, E., Wilson, K. A., Burke, C. S., & Wightman, D. C. (2006). Does crew resource management training work? And update, an extension, and some critical needs. *Human Factors, 48*(2). 392-412.

Schein, E. H. (2004). *Organizational culture and leadership,* 3rd edition. San Francisco: Jossey-Bass.

Schneider, B. (2000). The psychological life of organizations. In N. M. Ashkanasy, C. P. M. Wilderom, & M. F. Peterson (Eds.), *Handbook of organizational culture and climate* (pp. xvii-xxi). Thousand Oaks, CA: Sage.

Schneider, B., Bowen, D. E., Erhart, M. G., & Holcombe, K. M. (2000). The climate for service: evolution of a construct. In N. M. Ashkanasy, C. P. M. Wilderom, & M. F. Peterson (Eds.), *Handbook of organizational culture and climate* (pp. 21-36). Thousand Oaks, CA: Sage.

Schneider, B., Salvaggio, A. M., & Subirats, M. (2002). Climate strength: A new direction for climate research. *Journal of Applied Psychology, 87*(2). 220-229.

Straumsheim, P. A. (2007). *Assessing psychosocial work environments: A comparative study of survey instruments and interviews.* Unpublished master's thesis, University of Oslo, Norway.

Strauss, A., & Corbin, J. (1990). *Basics of Qualitative Research.* California: Sage Publications, Inc.

Svyantek, D. J., & Bott, J. P. (2004). Organizational culture and organizational climate measures: and integrative review. In J. C. Thomas (Ed.), *Comprehensive handbook of psychological assessment: Industrial and organizatinal assessment* (Vol. 4, pp. 507-524). Hoboken, NJ: Wiley.

Weick, K. E., & Sutcliffe, K. M. (2001). *Managing the Unexpected.* San Francisco: Jossey-Bass

West, M. A., Hirst, G., Richter, A., & Shipton, H. (2004). Twelve steps to heaven: Successfully managing change through developing innovative teams. *European Journal of Work and Organizational Psychology, 13*(2). 269-299.

Zohar, D. (2000). A group model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. *Journal of Applied Psychology, 85*(4). 587-596.

Zohar, D. (2002). Modifying supervisory practices to improve subunit safety: A leadership-based intervention model. *Journal of Applied Psychology, 87*(1). 156-163.

Zohar, D., & Luria, G. (2004). Climate as a social-cognitive construction of supervisory safety practices: Scripts as a proxy of behavior patterns. *Journal of Applied Psychology, 89,* 322-333.

Zohar, D., & Luria, G. (2005). A multilevel model of safety climate: cross-level relationships between organization and group-level climates. *Journal of applied psychology, 90*(4). 616-628.

Appendix

Introduction to interview and interview guide

Introduction to interview

(to be handed out to participants beforehand)

We are very grateful that you have taken the time to let us interview you. We are Master's degree students in psychology at the University of Oslo. During the following year we will be writing our Master's thesis in cooperation with Fortuna on evaluating their safety initiatives since 2002. Data from this interview will, together with all the other interviews we will be performing, create the basis for our analysis. The aim with this interview is to gain knowledge, insights and understanding of what you have experienced, what your views are and your thoughts and feelings are concerning safety in the organizational network, with an emphasis on the human side of safety.

We would like to tape record the interview so that important information will not be lost or forgotten. Only the two of us, together with our supervisors at the university will have access to the recordings. All the information you will be giving is anonymous and confidential. All names and personal identification will be deleted in the final thesis, and it will not be possible to trace any information back to you. Nothing you say will be known to any of your colleagues or to your employer. However, if you do not feel comfortable with recording the interview, we would like you to tell us, and the interview will not be recorded. Your participation is voluntary and you may, at any time, choose to end the session if you wish to do so. By answering the questions, you will give your consent to participate in this research.

The interview will be based on a technique called SWOT analysis, aiming to shed light upon four aspects of safety within the organizational network – strengths, weaknesses, opportunities and threats. The questions will be very open and general, so the focus in the interview will be largely up to you to decide. No answers are considered more correct than others; the only thing we are interested in is your honest opinion.

Date and place/Signature, interviewer Date and place/Signature, interviewee

Interview guide

Welcome to this interview. Did you read the introduction to the interview that we handed out to you? How do you feel about tape recording the interview? Do you have any questions before we start?

Demographic/practical information
We would like to start by asking you some demographic/practical questions such as age and position/rank. This will not be directly relevant to us, but might have an impact on your experiences and thoughts.

1. Position
2. Nationality
3. Sex
4. Age
5. *Which parts of Fortuna's safety campaign training have you completed? (only for crew onboard the vessel)*

The following questions will be related to safety (main questions)

What do consider strengths in this organizational network regarding safety?

What do you consider weaknesses in this organizational network regarding safety?

Can you think of any means for improving the quality of safety in the organizational network?

Can you identify any problems that would prevent better safety in the organizational network?

(Follow up questions for all main questions)

Could you say something more about that?
Can you give an example?
Can you think of anything else?
What do you mean by that?
Do I understand you correctly in that what you are saying is…?

Thank you for answering our questions! Do you have any questions regarding the interview or your anonymity?